Device/User Interface Software Requirements For Metrum BVLDS Cassette Digital Tape Recorder

Version 1.0

August 25, 1997

Submitted by: _____
Software Engineer Date

Approvals: _____
Hardware Engineer Date

_____
Operations Date

_____
Project Lead Date

Final and Signed 08/25/97

Table of Contents

1.0 Introduction

This document provides device and user interface requirements for the MetrumBVLDS Cassette Digital Tape Recorder.

2.0 Required Functionality

The Metrum BVLDS is a digital magnetic-tape drive that is used to capture and store real-time scientific data. It can store up to 10.4 gigabytes of data (with error correction) on a 120 minute tape cassette. When storing data at maximum rate and operating in two-channel mode, a T-120 tape will store a minimum of 43 minutes of data. It uses rotary helical-scan technology and standard commercial tape cassettes, much like consumer VCRs. The BVLDS can be configured with one or two channels.

Units that are used in automated tracking stations are configured with a single channel. Single channel units have data provided to the recorder buffer(s) at a rate of between one kilobitand thirty-two megabits per second. The transfer of data from a buffer to tape for a single channel unit is between one megabyte and two megabytes per second.

Automated tracking station implementations do not use the longitudinal read/write channel.

This device will be a part of the Recorder node and will be attached to a Metrum specific serial controller, which will in turn be attached to a digiboard general serial controller. Its data ports will be connected to the matrix switch. It is anticipated that all capabilities of the device will be used.

It is required that there be the high-level ability of the recorder to be able to report the success or failure of a record operation from the node to the master. The number of the tape and location on the tape of a particular orbit track (start PBN and stop PBN) is desired. It is understood that the Metrum does not record a time channel on a tape, rather just simple block numbers and file marks.

It is also required that the recorder report tape statistics (non correctable error counts for each of the channels, head hours, total operating hours and the like) such that a general picture of data reproduction quality can be created.

3.0 Parameter Ranges

Cassette digital tape devices will use the standard settings for record and reproduce thresholds. They will be defaulted at 128 blocks, which is about midway between the low end of 3 for recording and 7 for reproducing and the high end of 255 blocks for both recording and reproducing.

This unit will permit selection of a volume label to be place upon a to-be-recorded tape at tape formatting time. The volume label ranges from 1 to 65535. A volume label of 0 indicates that a tape will be formatted without a volume label.

Principal Block Numbers range from 1 to a maximum of 158,692 for T-120 tapes and 210,333 for T-160 tapes. The maximum number of file marks is 65,535. These ranges represent the minimum and maximum values that can be entered for the search commands such as search block number, and search filemark.

4.0 Communications Protocol

RS-232 Serial protocol will be used to communicate with this device. This device will be connected by way of a direct serial line. The port settings are as follows;

- Baud Rate 2400
- Stop Bits 1
- Data Bits 8
- Parity None

Other port settings are as follows.

- Data-Terminal-Ready control (DTR) Disabled
- Ready-To-Send control (RTS) Disabled
- Data-Set-Ready (DSR) Off

5.0 GUI Functionality

The user will be able to set the following remote controllable features contained in the following screens: **Control**, **Record**, **Reproduce**, **Format**, **Search**, and **Settings**. Each screen handles a portion of the interaction needs that users will need to exercise the device. A **Status** screen is provided to view the current settings and condition of the recorder.

The **Control Screen** has the following displays, settings and/or controls:

- **Rewind**
  -- This button will initiate a Fast Reverse command sequence to rewind the tape to the Beginning-Of-Tape (BOT) marker.
- **Reverse**
  -- This button will initiate a Reverse command sequence to move the tape backwards at normal speed.
- **Stop**
  -- This button will cause the tape transport to stop the current activity and then instruct the tape transport to enter standby mode and await further instruction. If the tape is in a form of recording, i.e. straight recording, dubbing recording, or recording a prescribed number of blocks, data sitting in a buffer awaiting transfer to tape will be flushed to the tape. Successful execution of a **Stop** will leave the tape in a defined state.
- **Forward**
  -- This button will initiate a Forward command sequence to move the tape forward at normal speed.
- **Fast Forward**
  -- This button will initiate a Fast Forward command sequence to move the tape forward at high speed to the End-Of-Tape (EOT) marker.
- **Eject**
  -- This button will initiate an Eject command sequence to stop the current activity and then unload the tape from the transport mechanism.
- **Standby**
  -- This button will cause the tape transport to stop the current activity (if it can be interrupted) and enter standby mode to await normal speed tape movement instructions.
- **File Mark**
  -- This button will cause the tape transport to write a file mark to the tape during a record session. This button is not available during playback mode.
- **Subload**
  -- This button will cause the tape transport to stop the current activity (if it can be interrupted) and enter subload mode to await high-speed tape movement instructions.
- **Self Test**

-- This button will cause the tape transport to stop the current activity and then perform a device Self Test. Self Test should not be attempted while data capture or reproducing is in progress. The tape will disengage from the scanner head and transport mechanism during a **Self Test**.

- **Halt**
  -- This button will cause the tape transport to interrupt and immediately stop the current activity. It should be used with great caution as data will be lost upon its use during operations when data is being moved on or off of a tape.

  -- If the tape is in a form of recording, i.e. straight recording, dubbing recording, or recording a prescribed number of blocks, an attempt will be made to flush data sitting in a buffer awaiting transfer over onto the tape.

  -- To insure that the recorder is in a defined state upon completion of a **Halt,** and to re-establish communication from the host to the tape unit (if it is lost) it may be necessary for the user to reload the settings in the last loaded configuration file.
- **Reset**
  -- This button will cause the tape transport to interrupt and immediately stop the current activity. It should be used with great caution as data will be lost upon its use during operations when data is being moved on or off of a tape. It should be noted that Resetmay cause the tape to eject if the Auto Eject was not earlier disabled from the **Settings** screen. This button will return the recorder to a hard-coded known state. The recorder will be placed into the following configuration:

  -- Auto Eject →Enabled
  -- Detect File Marks →Enabled
  -- Automatic Writing of filemark →Enabled
  -- Tape Reproduce Format →Ten Gigabyte with Buffered output
  -- Tracking parameter set →Default Autotrack
  -- Operating Mode →16-bit (word) width and Streaming (constant rate) data
  -- Tape Record Format →T-120 with No Direct Channel
  -- Record Threshold →set to 128
  -- Reproduce Threshold →set to 128

  -- If the tape is in a form of recording, i.e. straight recording, dubbing recording, or recording a prescribed number of blocks, an attempt will be made to flush data sitting in a buffer awaiting transfer over onto the tape.

  -- It will be necessary for the user to reload the settings in the last loaded configuration file upon the completion of a **Reset**.

The **Record Screen** has the following displays, settings and/or controls:

- **With Direct**
  -- This check box is used to select whether or not direct channel recording is to be used.
  -- Dubbing record is made not available when direct channel recording is selected.
  -- It is defaulted to Not Selected
- **Number of Blocks**
  -- This selection box is used to enter the number of blocks to be recorded. If this field is set to zero or is blank then a simple start recording is assumed.
  -- This box defaults to 0.
- **Buffer Threshold**
  -- This selection box is used to enter the number of Principal Blocks required to be in the record buffer prior to the buffer flushing itself to the tape. Entering a value here overrides the default.
  -- This value ranges from 3 to 255.

-- This box will default to a value computed from the number entered into the Record Stream Data Rate selection box in Bits Per Second

- **Record Stream Data Rate**
  -- This selection box is used to enter the anticipated rate of data to the recorder in Bits Per Second to avoid unnecessary standby timeouts. Upon successful entry the Buffer Threshold will be computed using the algorithm as detailed in the Metrum Device Manual page 3-10, section 3-8.4.6.1
  -- The Record Stream Data Rate ranges from 1.0 kilobits per second to 32.0 megabits per second.
- **Dubbing**
  -- This check box is used to select if the record session to be initiated will be as a tape dub between two Metrum recorders. The selection box for number of blocks to record is made not available. Direct channel recording is also made not available.
  -- Tape dub recording does not look for data to be present at the direct port on the transport nor does it convert the direct channel data from analog digital for recording on the tape. Instead it expects direct channel data (if any) to be present in the digital stream flowing in through the parallel data port. A different command sequence is initiated for dubbing record than for standard record.
  -- This check box is defaulted to Not Selected.
- **Record**
  -- This button is used to initiate the record command sequence with the options as selected in the other fields of the record screen.

The **Reproduce Screen** has the following displays, settings and/or controls:

- **First Block**
  -- This selection box is used to enter the number of the first principal block to be reproduced. If this box is blank or zero simple playback is assumed.
  --This box defaults to 0.
- **Last Block**
  -- This selection box is used to enter the number of the last principal block to be reproduced. If this box is blank or zero simple playback is assumed.
  -- This box defaults to 0.
- **File Mark**
  -- This selection box is used to enter the number of file marks forward of the current tape position to be reproduced. The Tape Dubbing check box, along with First Block and Last Block selection boxes, are made not available. Data will be reproduced until this number has been completed.
  -- This box defaults to 0.
- **Format**
  -- This drop-down selection box is used to select which tape format is to be used for data reproduction. This feature enables reproduction of tapes recorded on earlier model Metrum recorders. Selections include:
    -- Five Gigabyte Single Channel,
    -- TenGigabyte Single Channel,
    -- Five Gigabyte Dual Channel,
    -- Ten Gigabyte Dual Channel,
    -- Five Gigabyte Read-After-Write,
    -- Ten Gigabyte Read-After-Write,
    -- Five Gigabyte With Shadow,
    -- Ten Gigabyte With Shadow,
    -- Ten Gigabyte With Buffered.
  -- This box defaults to Ten Gigabyte With Buffered.
- **Buffer Threshold**
  -- This selection box is used to enter the number of Principal Blocks required to be read from the tape and placed in the buffer prior to data appearing at the output port. Entering a value here overrides the default.

-- This value ranges from 7 to 255.
-- This box will default to a value computed from the number entered into the Reproduce Stream Data Rate selection box in Bits Per Second

- **Reproduce Stream Data Rate**
  -- This selection box is used to enter the anticipated rate of data from the recorder in Bits Per Second to avoid unnecessary standby timeouts. Upon successful entry the Buffer Threshold will be computed using the algorithm as detailed in the Metrum Device Manual page 3-10, section 3-8.4.6.2
  -- The Reproduce Stream Data Rate ranges from 1.0 kilobits per second to 32.0 megabits per second.
- **Dubbing**
  -- This check box is used to select if the reproduce session to be initiated will be part of a tape dub. Tape Dub selection will cause the File Mark check box, along with the First Block and Last Block selection boxes to be made not available.
  -- Tape dub reproduction does not convert any direct channel data on the tape to analog for presentation to the direct port on the transport. Instead, direct channel data remains digitized for the receiving unit. Note, too that the receiving unit must also have Dubbing selected prior to initiating its respective Record command sequence.
  -- This check box is defaulted to Not Selected.
- **Reproduce**
  -- This button is used to initiate the reproduce command sequence with the options as selected in the other fields of the reproduce screen.

The **Format Screen** has the following displays, settings and/or controls:

- **Tape Length**
  -- This radio button is used to select either of T-120 (standard 120 min) or T-160 (extended 160 min) tapes.
  -- These buttons default to T-120.
- **Label**
  -- This selection box is used to specify the desired volume label to be placed upon the tape at format time. A zero or blank field denotes that there will be no volume label placed on the tape. -- -- This box defaults to 1.
- **With Direct**
  -- This check box is used to specify that the tape should be formatted with direct channel recording enabled. Note that direct recording or reproduction is not possible on tapes that did not have direct enabled at tape format time.
  -- This box defaults to Not Selected.
- **Format**
  -- This button is used to initiate the format command sequence with the options as selected in the other fields of the format screen.

The **Search Screen** has the following displays, settings and/or controls:

- **Search End Of Data**
  -- This radio button is used to select a search to locate the end of data on the tape. The search will cease at the End-Of-Tape (EOT) marker if the tape is full.
- **Search Principal Block**
  --This radio button is used to enable the selection of a specific principal block is to be located.
- **Search Principal Block**
  -- This selection box is used to enter which Principal Block Number is to be located.
  -- This field defaults to 1 which is at the Beginning-Of-Tape (BOT) marker.
- **Search File Mark Forward**

-- This radio button is used to search forward to the next file mark. This button is made not available if the **Detect File Marks** on the **Settings Screen** is not selected. The search will cease at the End-Of-Tape (EOT) marker if there are no more file marks on the tape following the search start point.

- **Search File Mark Reverse**
  -- This radio button is used to search backwards to the next file mark. This button is made not available if the **Detect File Marks** on the **Settings Screen** is not selected. The search will cease at the Beginning-Of-Tape (BOT) marker if there are no more file marks on the tape prior to the search start point.
- **Search**
  -- This button is used to initiate the search command sequence with the options as selected in the other fields of the search screen.

The **Settings Screen** has the following displays, settings and/or controls:

- **Automatically Write File Marks**
  -- This check box is used to select whether or not file marks will be automatically written at the conclusion of record sessions. Initially, the state read from the configuration file and sent to the recorder is displayed.
- **Auto Eject**
  -- This check box is used to select whether or not the tape will automatically eject upon a self test and/or in response to an Eject request. Initially, the state read from the configuration file and sent to the recorder is displayed. It should be noted the tape will eject upon issue of a command to disable **Auto Eject**. This is done to provide the user a last opportunity to remove the tape prior to setting. Moreover, if **Auto Eject** is enabled the tape will be ejected upon power-on start up and upon issuing a **Reset** to the recorder.
- **Detect File Marks**
  -- This check box is used to enable / disable transport sensitivity to the presence of file marks on a tape. This feature is generally used during tape dubbing where it is normally turned off to speed copying of complete tapes. All other times it should be selected. Initially the state read from the configuration file and sent to the recorder is displayed.
- **Operating Mode**
  -- This combination of radio buttons is used to select one of four operating modes:
    -- 16 bit Word width with Streaming (constant rate) data
    -- 16 bit Word width with Burst (variable rate) data
    -- 08 bit Byte width with Streaming (constant rate) data
    -- 08 bit Byte width with Burst (variable rate) data
  -- Initially the state read from the configuration file and sent to the recorder is displayed.
- **Set**
  -- This button is used to initiate the command sequence to set the desired features with the options as selected in the other fields of the settings screen.

The **Status Screen** has the following displays, settings and/or controls:

- **Tape Mode**
  -- This field displays the current state of the recorder. This field will show the various states as the recorder transitions from one mode to the next. Examples of what may be displayed follow:
    -- Idle
    -- Subload
    -- FastForwarding
    -- FastReversing
    -- Standby
    -- Forwarding
    -- Reversing

-- Recording
-- Reproducing
-- UnknownState

- **Block Number**
  -- This field displays the current block number during activities that involve movement of data on and off of the tape such as recording, playback, and searches.
- **Format View**
  -- The tape type field displays the type of tape and the type of formatting that has been selected for formatting and recording. Examples of what may be displayed follow:
    -- T-120 w/o Direct
    -- T-120 w/ Direct
    -- T-160 w/o Direct
    -- T-160 w/ Direct
  -- The label field displays the volume label of the currently loaded tape. If it is blank or zero the currently loaded tape does not have a volume label.
- **Reproduce View**
  -- The Buffer Threshold field displays the current reproduce buffer threshold selected for the recorder.
  -- The Playback Format field displays the type of format that has been selected for use during tape playback. Examples of what may be displayed follow:
    -- Five Gig / Single Channel
    -- Ten Gig / Single Channel
    -- Five Gig / Dual Channel
    -- Ten Gig / Dual Channel
    -- Five Gig / Read After Write,
    -- Ten Gig / Read After Write,
    -- Five Gig / with Shadow,
    -- Ten Gig / with Shadow,
    -- Ten Gig / with Buffered
- **Record View**
  -- The Buffer Threshold field displays the current record buffer threshold selected for the recorder.
- **Settings View**
  -- The Operating Mode field displays the tape operating mode currently selected. Examples of what may be displayed follow:
    -- Word & Streaming
    -- Word & Burst
    -- Byte & Streaming
    -- Byte & Burst
  -- The Auto File Marks field displays whether or not the automatic writing of file marks has been selected.
  -- The Auto Eject field displays whether or not Tape Eject has been enabled.
  -- The Detect File Marks field displays whether or not read sensitivity to file marks has been enabled.
- **Tape Usage View**
  -- This field displays the remaining amount of tape available as a percentage of the total capacity of the tape. Users can use this field to determine if the amount of tape remaining on a cassette is sufficient for a scheduled data capture session.
- **Recorder Health**
  -- This indicator shows if the recorder is available and is functioning normally. Normal health is indicated by green, abnormal function, i.e. faults, are indicated by red.

6.0 Command Scripting

See Appendix B: Scripting Requirements

7.0 High-level Status

A ‘fault’ light is displayed in the Status Screen to show if the recorder is functioning normally. Normal function is displayed in green, abnormal function is shown in red. Currently the recorder returns the current block number. It is polled by the node once every two seconds.

8.0 Replacement Algorithm

If a unit is deemed not responsive, operator intervention will be required to substitute a working unit to replace the failed one.

Appendix A: Graphical User Interface Requirements

The user will be able to access the following remote controllable features. These features are outlined in detail in Section 5.0, GUI Functionality.

Appendix B: Scripting Requirements

Master	Node	Comments/Error Handling

Resource Request Specific
Parameter: unit number
	Start
	
	Check allocation table for unit number
	
	If available then
	Mark unit as assigned to this Master
	Reply “Unit # assigned”
	Open log file
	Retrieve configuration file from this Master
	Else
	Reply “Unit # not available”
	End
	
	Stop	

Resource Request General	Start
	
	Check allocation table for an available unit using the least recently used method
	
	If available then
	Mark unit as assigned to this Master
	Reply “Unit # assigned”
	Open log file
	Retrieve configuration file from this Master
	Else
	Reply “No units available”
	End
	
	Clear any Exception Halts on recorder
	
	Confirm that transport is alive
	Do a Reset to synchronize software settings with transport settings	

Master	Node	Comments/Error Handling
	Inquire if a tape is loaded Inquire if the tape is formatted Inquire if tape is write protected Obtain the volume label of the currently loaded tape Stop	>> Operator intervention to load a tape >> Operator intervention to format a tape >> Operator intervention to write protect tape if desired >> Operator intervention to eject wrong tape and load desired tape

Setup
Parameter: unit number
	Start
	
	Verify possession of unit by this Master
	
	If not assigned to this Master then
	Inform this Master
	Stop
	End
	
	Write log entry to announce presence of this tape
	
	Load and Verify configuration file
	
	If configuration file error then
	Inform this Master
	Stop
	End
	
	If recording then
	-- Setup for Recording
	-- Search for End-Of-Data
	-- Check for Search Failure
	-- Show Current Tape Format Mode
		
		>> Operator intervention required
		
		>> Operator intervention required

Master	Node	Comments/Error Handling

	-- Show Current Tape Volume Label
	Else
	-- Setup for Playback
	-- Search for Start Playback PBN
	-- Standby to await start of playback
	Endif
	
	Stop	

Start Support
Parameter: unit number
	Start
	
	Verify possession of unit by this Master
	
	If not assigned to this Master then
	Inform this Master
	Stop
	End
	
	If Recording then
	-- Issue Record Command Sequence
	-- Log Record Starting PBN
	Else
	-- Log Start Playback PBN
	-- Issue Playback Command Sequence
	Endif
	
	Stop
		>> Operator intervention required

Stop Support
Parameter: unit number
	Start
	
	Verify possession of unit by this Master
	
	If not assigned to this Master then
	Inform this Master
	Stop
	End
	
	If Recording then
	-- Obtain End-Of-Record PBN
		>> Operator intervention required

Master	Node	Comments/Error Handling

	-- Issue Stop & Standby Cmd Sequences
	-- Gather and log device operating stats
	Else
	-- Obtain End-Of-Playback PBN
	-- Issue Stop & Standby Cmd Sequences
	-- Gather and log device operating stats
	Endif
	
	Stop	

Takedown Parameter: unit number	Start Verify possession of unit by this Master If not assigned to this Master then Inform this Master Stop End Eject the tape Mark unit as not assigned Close log file Send log file to this Master Stop	>> Operator intervention required